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sixths to three and one-half inches long the whole of the chondrocranium, with its visceral arches, has become sauropsidan, and the investing bones are quite crocodilian in number and relation. The chondrocranium is better developed than in any existing reptile or bird. The mandibular arch in the crocodile is the culmination of the oviparous type. In the early stages the mandibular suspensorium is extremely like that of the more generalized selachians. There is a distinct suprastapedial element in the hyoid arch.

Birds.—The "cape wigeon" of Latham, and *Anas capensis* of Gmelin, is noted by T. Salvadori as occurring in Shoa. It is redescribed as *Querquedula capensis.*——Mr. R. B. Sharpe describes an apparently new nuthatch (*Sitta whiteheadi*) from the mountains of Corsica.

EMBRYOLOGY.[1]

ON THE GENESIS OF THE EXTRA TERMINAL PHALANGES IN THE CETACEA.[2]—In what manner the extra terminal phalanges of the second, third and fourth digits of the manus of such a type as Globiocephalus amongst Cetaceans, was evolved, has been a question which my studies gave little hope of satisfactorily answering until I had noticed that the bony digits of both the manus and pes in the pinnipeds are prolonged into the flat terminal integuments of the limbs far beyond the nails as unsegmented bars of cartilage, which are really unossified extensions of the ungual phalanges. The nails are borne upon the dorsal aspect of the ungual phalanges in pinnipeds, the ossified shafts of these phalanges usually ending abruptly to be continued into the terminal bars of cartilage. In Histriophoca the terminal cartilaginous extension of the last joints of the digits are quite rudimentary, but the point where the ungual phalanges abut distally upon the terminal cartilages is still visibly marked in this species. In the walrus, the fur-seal and sea-lion the terminal cartilages of the digits are more developed, and articulate directly with the abruptly truncated ends of the ungual phalanges. In the manatee the ungual phalanges of the manus terminate abruptly; that they support cartilaginous extensions of notable length seems improbable. The terminal cartilages of the digit apparently reach their greatest or strongest development in the walrus.

The foregoing data when interpreted by the aid of embryological theory, as actually observed to hold in other forms, and linked with the explanations afforded by other facts which will be given later on, will, it seems to the writer, gives us a rational hypothesis of the origin of the extra-terminal digits in the manus of the whales.

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[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

[2] This note presents the substance of conclusions reached by me in my memoir entitled, "On the development of the Cetacea, together with a consideration of the probable homologies of the flukes of cetaceans and sirenians," now in press.

That the digits of the Cetacea develop as part of the continuous blastema of the embryonic appendicular skeleton as in other vertebrated animals, there can be no doubt. That the joints and segments of their limbs also become gradually defined in serial order from the shoulder and hip girdles outward, also admits of no doubt, as may be seen upon studying sections of the manus, a quarter inch in length, of a fœtal Globiocephalus two inches in total length. In like manner there can be no doubt of the fact that the cartilaginous extensions of the ungual phalanges of pinnipeds are a part of the original blastema from which the ossified portions of the skeleton of the limbs of these animals has developed.

In man the shafts of the three phalangeal segments of the digits of the manus ossify almost contemporaneously. In Globiocephalus, on the other hand, in a specimen one-third grown, it is found that the proximal segments of the second and third digits ossify apparently at about the same time as their isomeres in the first, fourth and fifth digits, whereas the distal or *extra* peripheral segments develop ossific centers enchrondrally much later. These data, therefore, indicate that the extra terminal phalangeal segments of the Cetacea have been added to the digits of the manus since the three proximal ones have been formed, which are normally characteristic of the digits of other mammals.

In fact, the development of the manus of Globiocephalus shows that while the metacarpal elements and first three or four phalangeal segments of the second and third digits ossify simultaneously, the four to six extra distal segments ossify in succession towards the distal periphery, the terminal elements of the digits being the last in which ossific centers appear.

Granted, then, that the extra terminal digital segments of the whales are ontogenetically as well as phyletically of later origin than the proximal ones, the only source from which it is possible to conceive them to have been derived is from such cartilaginous extensions of the ungual phalanges of some ancestral seal-like form, or from the cartilaginous extensions of the digits of the Protocetacea, which may for our purpose, be considered to represent a hypothetical type. These cartilaginous extensions, if segmented a number of times, would afford the basis for the development and ossification of the extra terminal digits of the existing whales. In fact, in some of the existing seals these cartilaginous prolongations of the ungual phalanges are long enough in the pes to afford the basis for three new and additional segments to each digit, as long as the three normally developed in each toe.

The proof that the extra terminal segments of the digits of the cetacean manus have been added distally, is the fact that the structure of the carpus is not, in any essential feature, different in structure from that of other mammals so far as the presence or absence of elements normally formed is concerned. I am therefore constrained to believe that it has been through a seal-like ancestry with prolonged integuments to the manus, in which the nails were not terminal but dorsal, beyond which the ungual phalanges were extended as bars of cartilage, which gave rise, by transverse segmentation and subsequent ossification to extra terminal digital segments as found in existing Cetacea.

The second fact of importance to be considered as lending probability to the foregoing view is the circumstance that when a limb is in its primitive cartilaginous condition it always develops its segments from its axial end toward its peripheral end in serial order. The basis for the extra terminal segments was first developed through the influence of functional adaptation, as cartilaginous bars or extensions of the primitive cartilage of the ungual elements of the digits in response to the demands made upon the limb in swimming. The segmentation of these terminal cartilaginous bars then followed through the influence of mechanical strains acting upon the cartilaginous terminal bars as these were alternately bent in opposite directions. These conclusions might be still further illustrated by data obtained from the observation of the development of the limbs of other animals.

These views, very forcibly it seems to me, sustain the hypothesis that the Cetacea are the off-shoots of land forms which were at first terrestrial, or at least amphibious, as are the pinnipeds. Such views do not at least run counter to any morphological facts, but in reality are sustained by them.—*John A. Ryder.*

ON THE MANNER IN WHICH THE CAVITY OF THE HEART IS FORMED IN CERTAIN TELEOSTS.— Balfour (Comp. Embryol., II, 523) states that "in Teleostei the heart is formed as in birds and mammals by the coalescence of two tubes, and it arises before the formation of the throat." I would now point out that this is not universally true of all teleostean forms, in fact it seems not to be the mode of cardiac development in any species of this group so far investigated.

My own observations on this point have been made upon the embryo cod-fish,[1] and indicate very conclusively, so far as transparent views are of value in deciding such a difficult matter, that the lumen of the heart arises as a single and not as a double cavity which afterwards blends to form a single one, as in birds and Mammalia. Moreover, this cavity is from the first open below, and is present in the cod embryo, on the fifteenth day, as a round opening limited all round by mesoblastic cells. Its transverse diameter at this stage is .043^{mm,} and is probably half as deep. It has the appearance of a round perforation in the mesoblastic plate of cells which probably gives rise to the endothelium of the cardiac cavity, the lining of the pericardial cavity and muscular wall of the heart, and which underlies the fore-gut as a transverse band of tissue. The cardiac lumen, as observed by myself to appear in the living embryo, occupies, *ab initio*, such a position that the median vertical plane passing through the embryo lengthwise would divide it.

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[1] Contrib. Embryog. Oss. Fishes, pp. 82–86.

Its floor, which corresponds to its future venous end, seems to be devoid of cells, and is formed apparently by the periblast covering the yolk. In the later stages of cardiac development in forms which have no complete circulation at the time of hatching, this is invariably the case, the venous end of the heart opening directly upon the surface of the periblast, as is shown in longitudinal sections of such stages.

As elsewhere stated, the yolk is here absolutely excluded from the intestine, and the arrangement above described then provides the passage-way for yolk material into the general circulation as it is segmented off from the periblast, as shown by Kupffer, Gensch and myself. This also bring the segmentation cavity and the blood vascular channels into actual continuity.

The investigations of Hoffmann[1] upon the development of the heart in Salmo are based entirely on sections, and begin with a stage long prior to the time when the organ begins to pulsate, and corresponds pretty closely to the stage of development seen in the cod embryo described above, which was observed about two days before pulsation began, when the heart became for the first time distinctly tubular, its lumen in the early stage here considered, being a mere flat, discoidal vacuole with vertical side-walls formed of cells. At a later stage of development the axis of the lumen of the cardiac cavity is horizontal instead of vertical.

Hoffman concludes that the endothelium of the heart is derived from the hypoblast, in which a short tubular cavity at once appears, the long axis of this endothelial tube coinciding in direction with the axis of the embryo. The myocardium or muscular outer wall of the heart is derived from the splanchnopleural plates which grow on either side of the embryo from above downwards and inward under the fore-gut, below which they approximate, their free ends finally investing the endothelial vesicle or tube, which represents in the salmon the vacuole above described in the cod embryo, which is the first trace of the cardiac lumen. After the muscular layer of the heart is supplied by the splanchnopleural plates, the foundation of the structure of the adult heart has been laid.

In neither of the foregoing accounts is there anything which suggests very much similarity between the mode of development of the first traces of the unpaired rudiment of the teleostean heart and that of Aves or Mammalia which arises by the fusion in the median line of a pair of cavities on either side of the latter, which are for a time shut off from each other by a septum.—*John A. Ryder.*

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[1] Zur Ontogenie der Knochenfische, Pts. VII, VIII. Amsterdam, 1882.

PSYCHOLOGY.

CURIOSITY OF MONKEYS.—"Do monkeys learn by experience?" is asked in your last number by Mr. W. H. Frost, who cites cats as learning in regard to their reflection in a mirror, and further states that it is claimed, on tolerable good authority, that monkeys never do, which statement he does not attempt to answer.

It seems to me that the probable explanation of the difference of action of the two animals in the matter is due, not to the superior powers of discernment, and capacity of learning by experience possessed by the cat, as one would infer from the article mentioned, but just the reverse.

I should doubt very much but that the monkey realizes in time that there is no other individual behind the glass, and think that its actions are simply due to the greater mental development which it possesses, and which is largely manifested by its investigative turn of mind, and could we understand the monkey language, it would tell us that it was a problem which it was trying to work out, and that while it felt that it was no genuine or ordinary monkey which appeared in the glass, it was curious to find out just what it was.

The monkey's mind, from long experience, has an innate consciousness of power to solve many of the problems presented to it, and being in a comparatively active state of evolution, is continually grasping out at new ideas.

The cat's mind, on the other hand, is not of such a progressive type, and consequently it quietly gives up many problems with "I cannot comprehend," and ceases to "bother its head about it," simply accepting the problem as it appears to it—a harmless, unexplainable phenomenon.—*Eugene N. S. Ringueberg, Lockport, N. Y.*

THE INVERNESS DOG "CLYDE."—Further letters respecting the Inverness dog "Clyde" tend to increase our respect for the sagacity of that individual. Its owner asserts that he taught himself to go to the baker's shop with money, and that he does intentionally and knowingly steal, hiding the money in his mouth. He will often hide some pieces in some corner known only to himself, ready to spend on occasion. If told to raise his head he will however, do as ordered, and the donor can then put the money in the box. A particularly innocent look upon his face indicates to his owner that he has money in his mouth, but he will disgorge when commanded. On one occasion when he was ordered to come to receive the punishment due for disobedience, he sprung into the canal instead; and, on another, when told to go to the baker to get some water to drink; he brought a tin bowl out of the back room and set it down before the baker, looking at him as if to say, "Don't you see what I want?"